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Application of Biota Assessment Approach to a Site With a Past Uranium Mining and Milling Activities

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OUTLINE

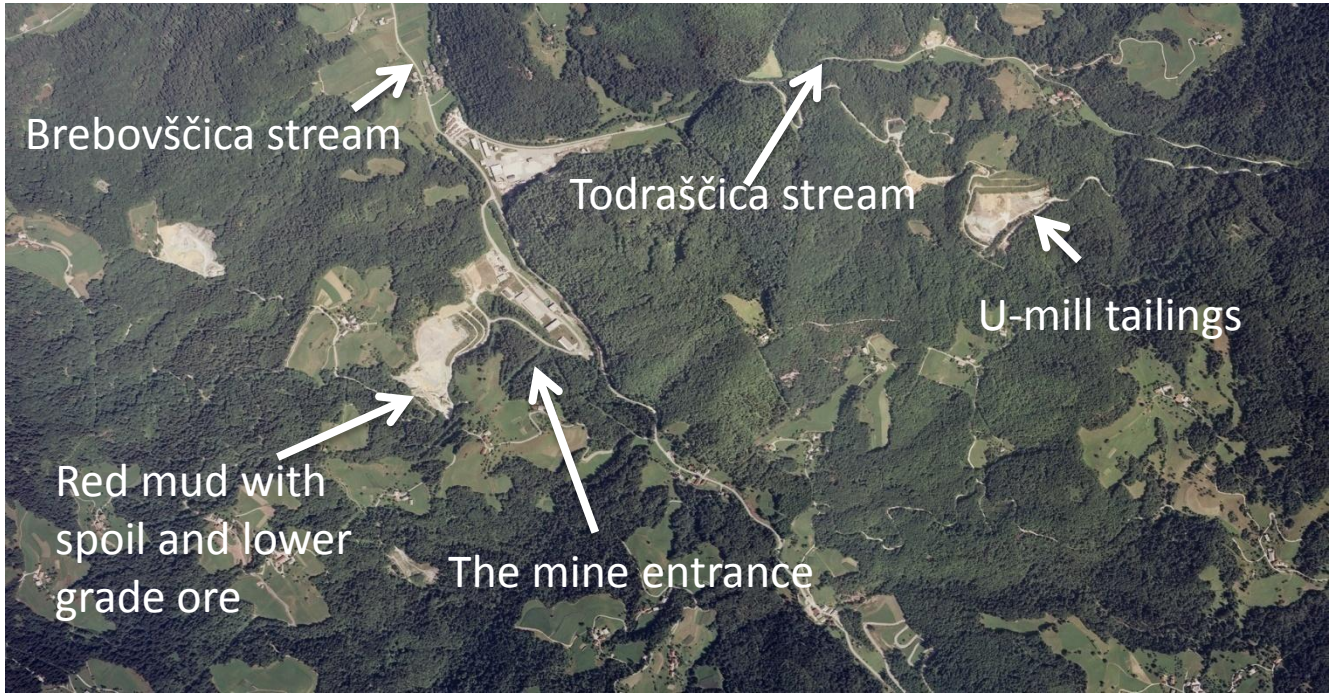
- **INTRODUCTION** → Former uranium mine, biota assessment approach
- **MATERIALS AND METHODS** → field work, assessment with ERICA Tool
- **RESULTS** → Dose rates to biota , radiological risk to biota
- **CONCLUSION**

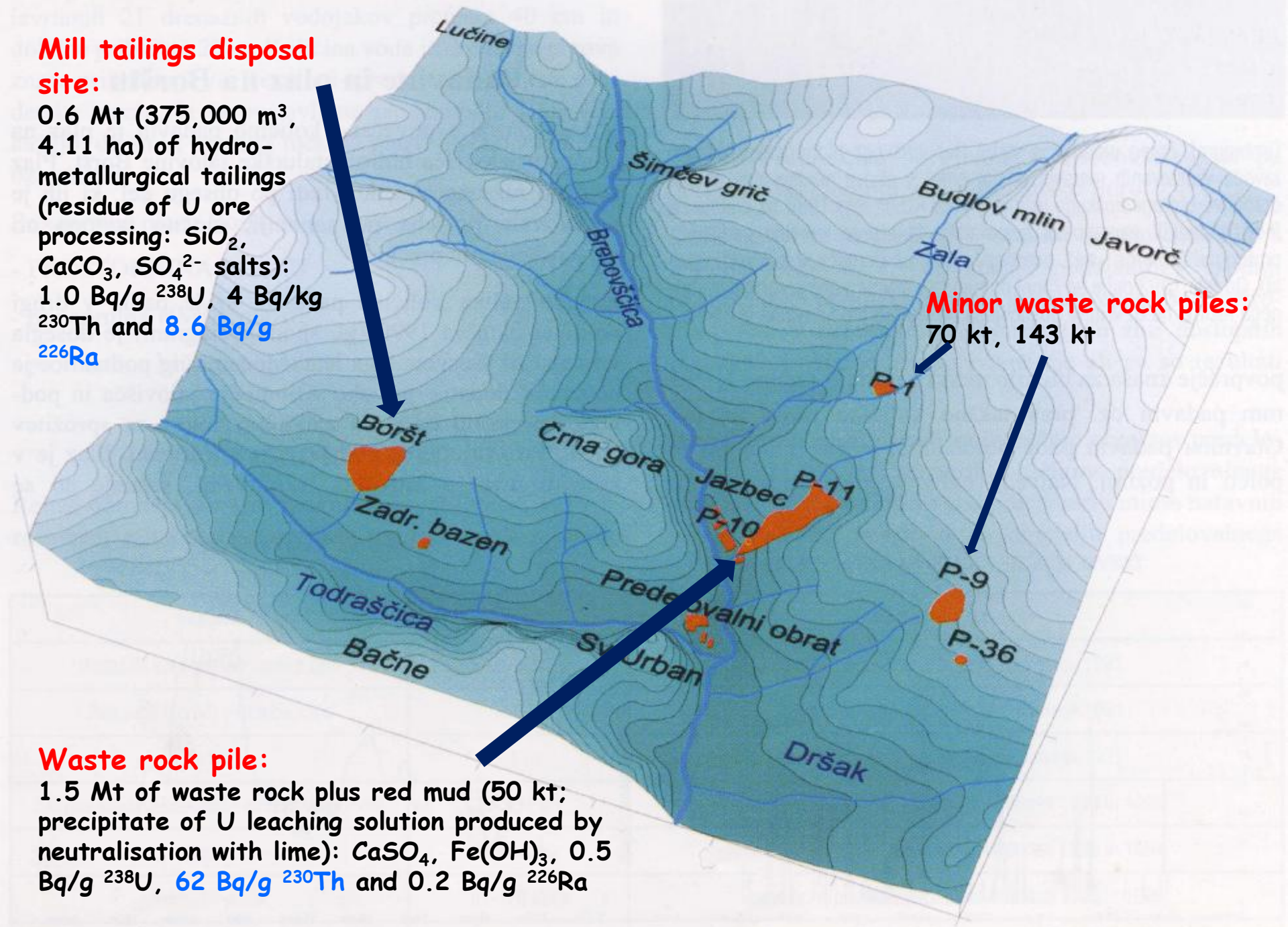
INTRODUCTION

- Uranium mining and milling activities in Slovenia were in full operation from 1985 to 1990 when 600.000 tons of uranium ore were processed during that time

- The mine has two disposal sites with U-mill tailings deposited at the Boršt and and red mud with spoil and lower grade ore at the Jazbec site

- Emission of natural radionuclides to the nearby habitats has often occured due to flow of tailings and mine waters to the local streams (Todraščica and Brebovščica)





Panoramic view at the Žirovski vrh area, size 4 x 4 km – view towards south

- Mine area was under constant monitoring surveillance from the beginning of mine operation, with aimed to measure critical radionuclides, such us U-238, Ra-226 and Pb-210 in water, sediment, soil, fish and lichens

- Due to long-term radioactivity discharge to the local streams the potential radiological risk to frehwater and terrestrial biota could be observed

- Biota risk assessment should be performed

MATERIALS AND METHODS

- ERICA Tool, level Tier 2 was applied for the biota risk evaluation
- Native aquatic and terrestrial species, such us Brown trout, Stone crayfish, Soft rush, Marsh marigolds and Tall Moor Grass were assumed as target organism exposed to potential radiation impact
- Ra-226, U-238 and Pb-210 for aquatic biota and Ra-226, U-238 and Th-230 for plants were included in the assessment
- Monitoring data were used as input data for the assessment

- A case of assessed biota in the vicinity of a former uranium mine

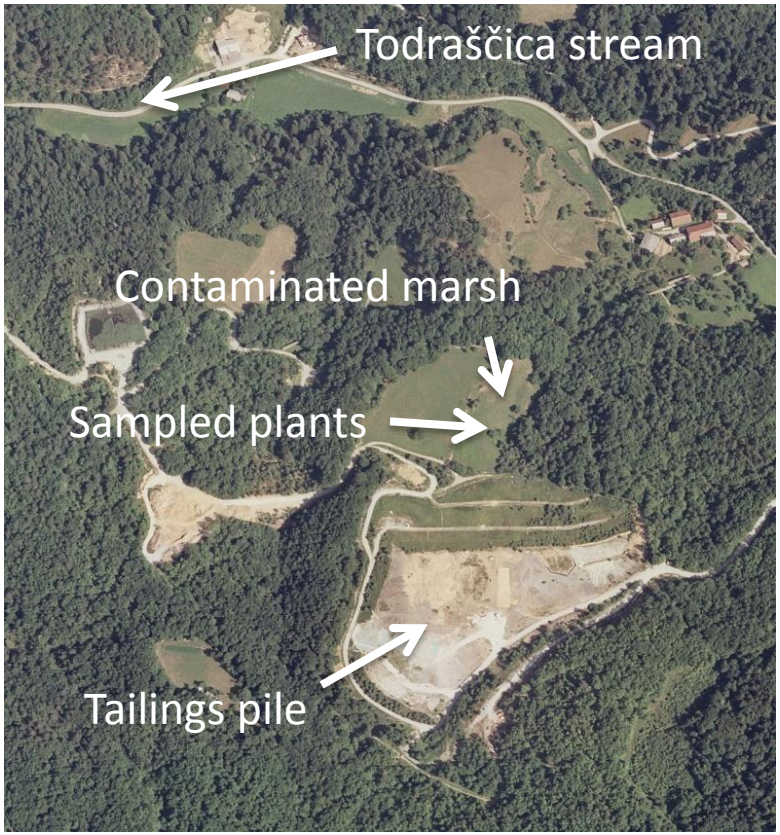
Brown trout

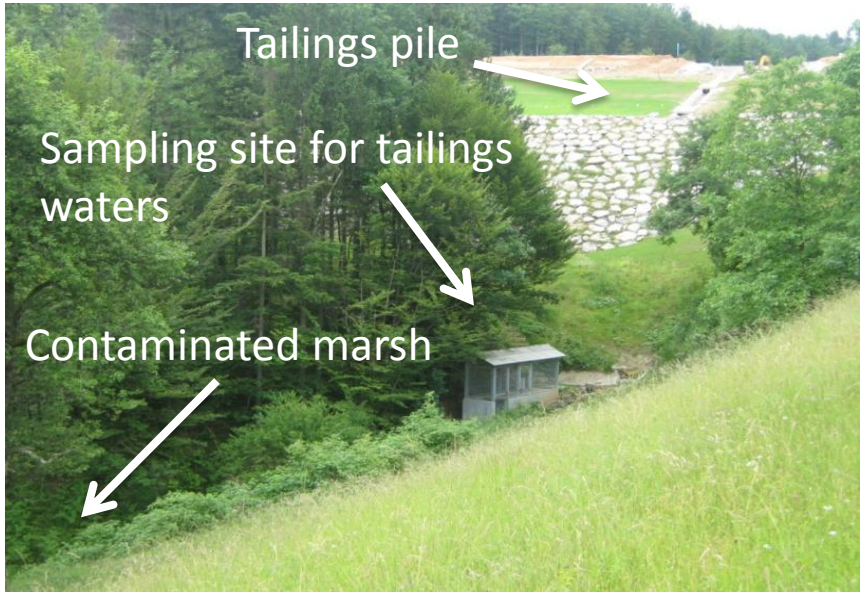
Stone crayfish

Tall Moor Grass

Marsh marigolds

Soft rush


Todraščica stream
Contaminated marsh
Sampled plants
Tailings pile

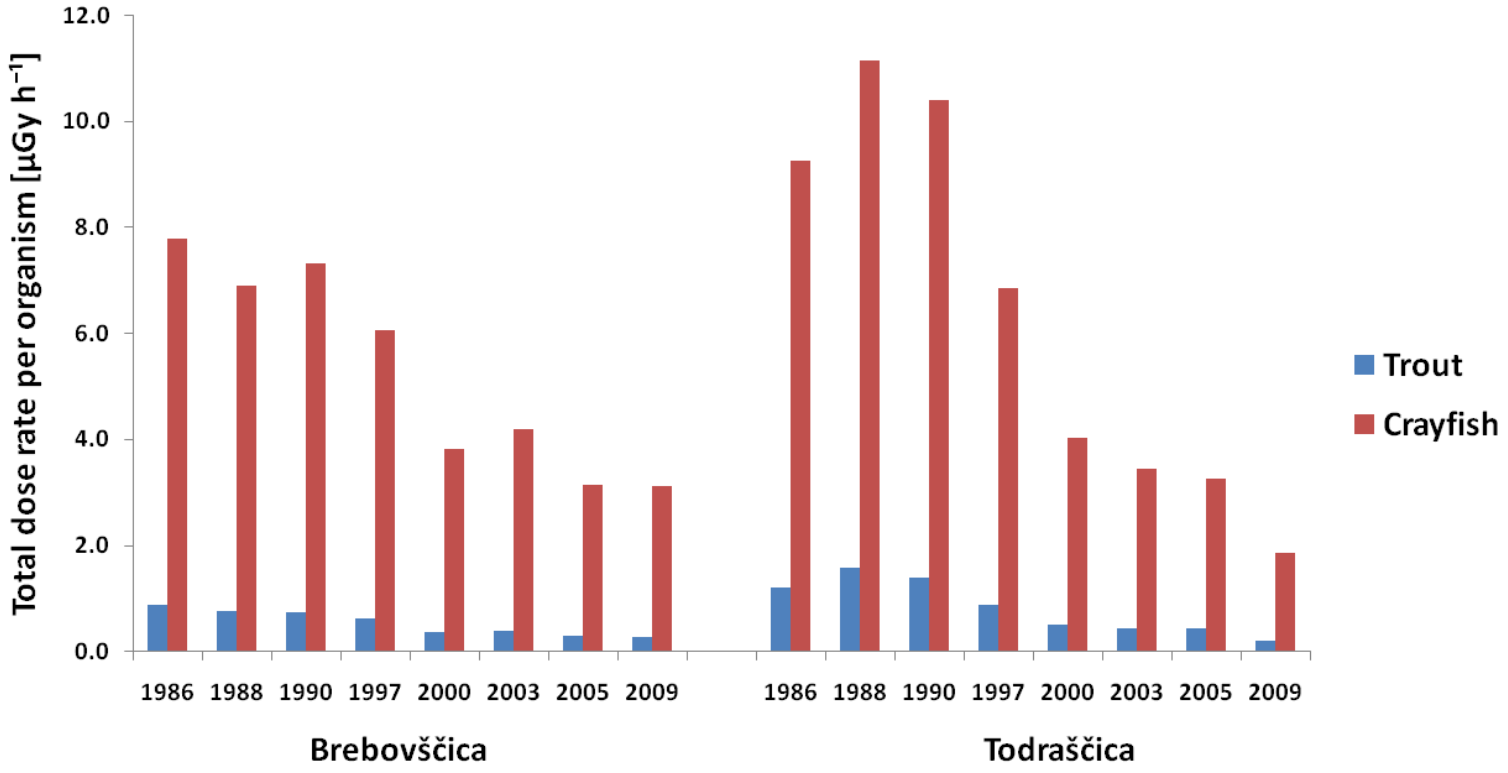

Tailings pile
Sampling site for tailings waters
Contaminated marsh


Contaminated marsh

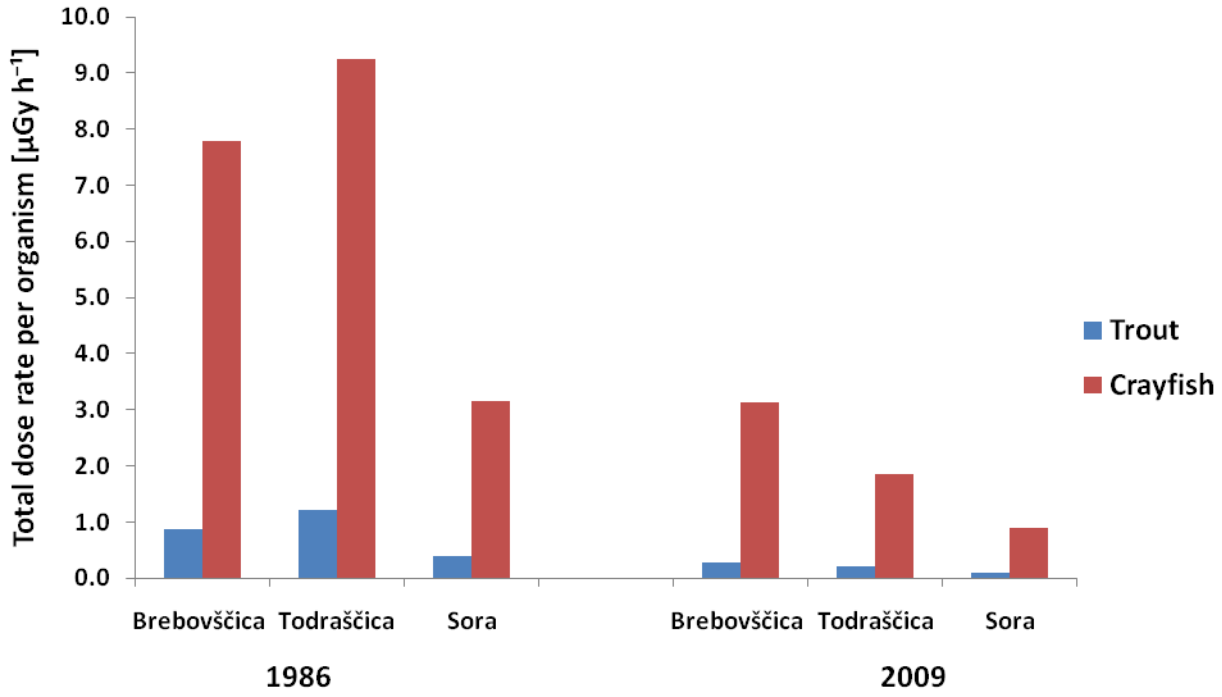
- Monitoring and ERICA default CR values were applied in the model
- The screeening dose value of 400 μG h^{-1} was used in the assessment as recommended by the IAEA and U.S. DOE for aquatic organisms and terrestrial plants
- Target organisms used in the model were created using real geometry and mass data

RESULTS

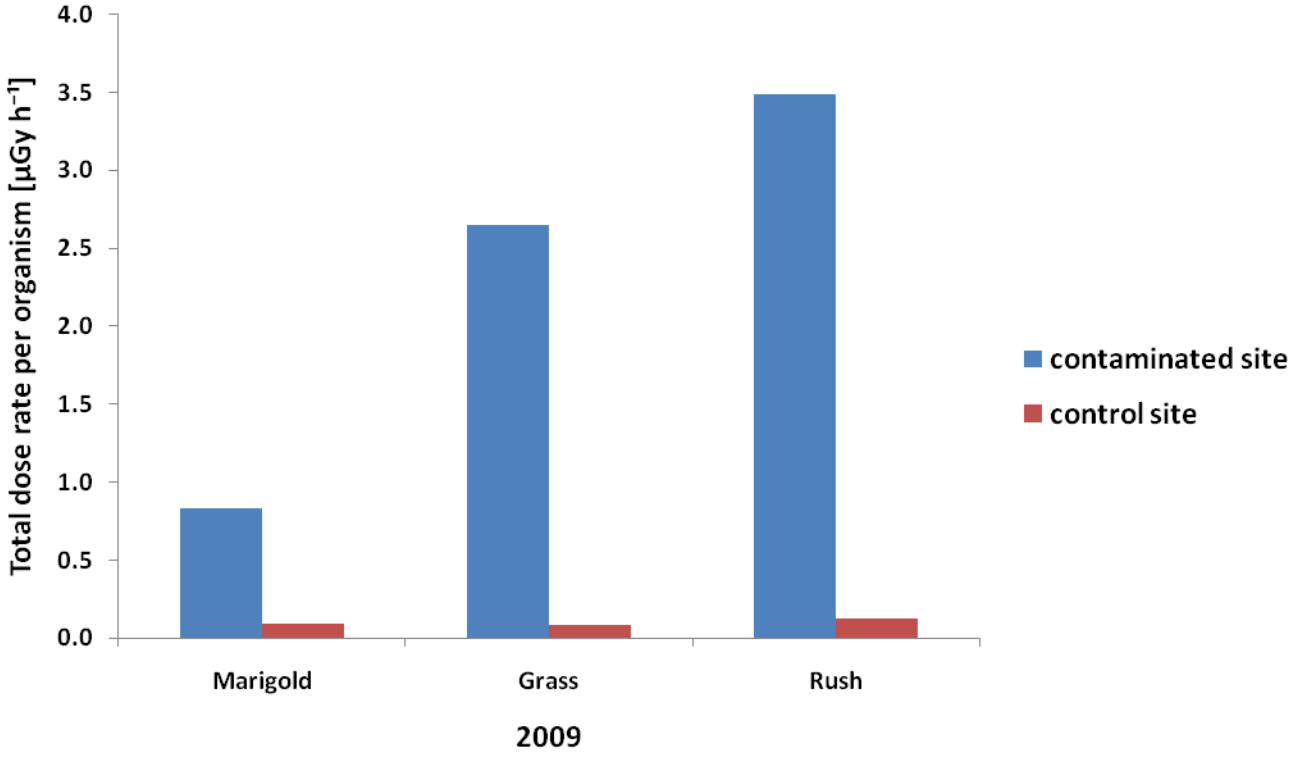
- Aquatic biota→ total dose rates per organism



- Aquatic biota→ total dose rates per organism



- Terrestrial plants → total dose rates per organism



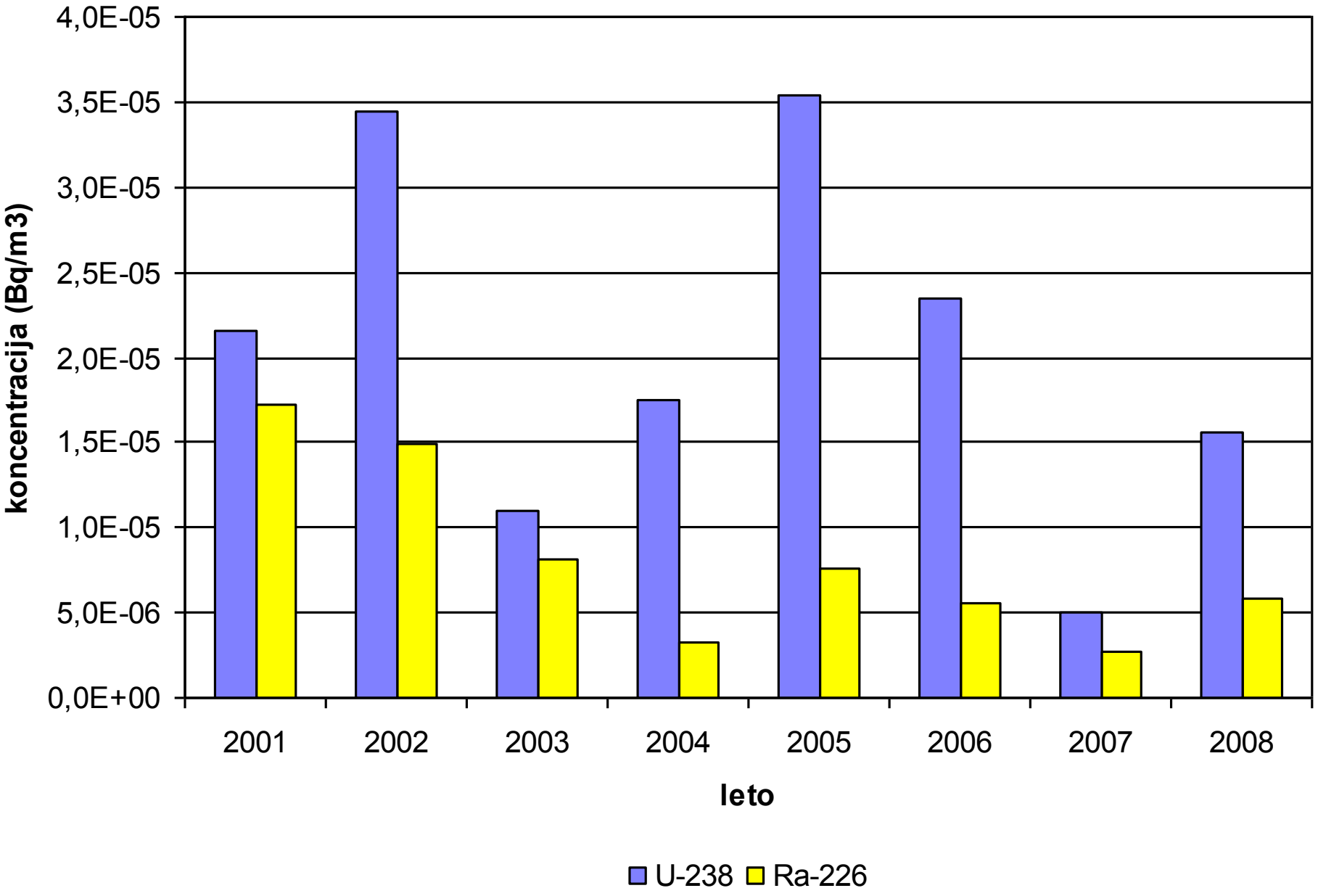
- Biota risk evaluation - no environmental risk from ionising radiation to aquatic and terrestrial biota was observed as screening value 400 µGy h^{-1} was not exceeded

- Stone crayfish would be exposed to environmental risk in the case of ERICA screening dose value (10 µGy h^{-1}) but in our case this would be negligible due to application of higher dose limit for the assessed organisms

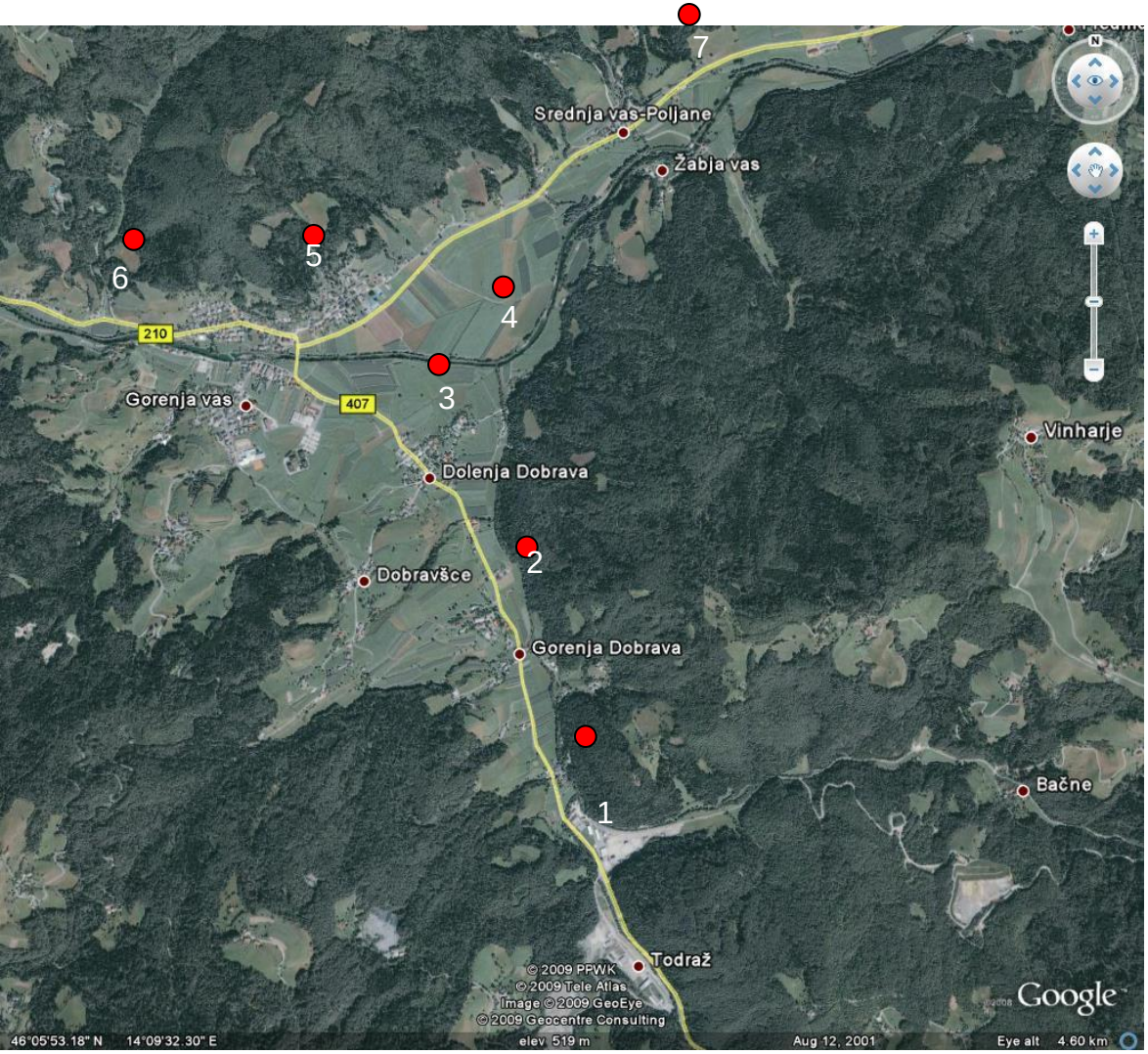
CONCLUSIONS

- Assessment revealed that no environmental risk to aquatic biota and terrestrial plants was observed due to radioactivity discharge into the local streams
- Predicted dose rates to aquatic biota were the highest during the mine operation in both streams
- Todraščica stream resulted in higher biota dose rates compared to Brebovščica stream
- Stone crayfish received evidently higher dose rate compared to Brown trout

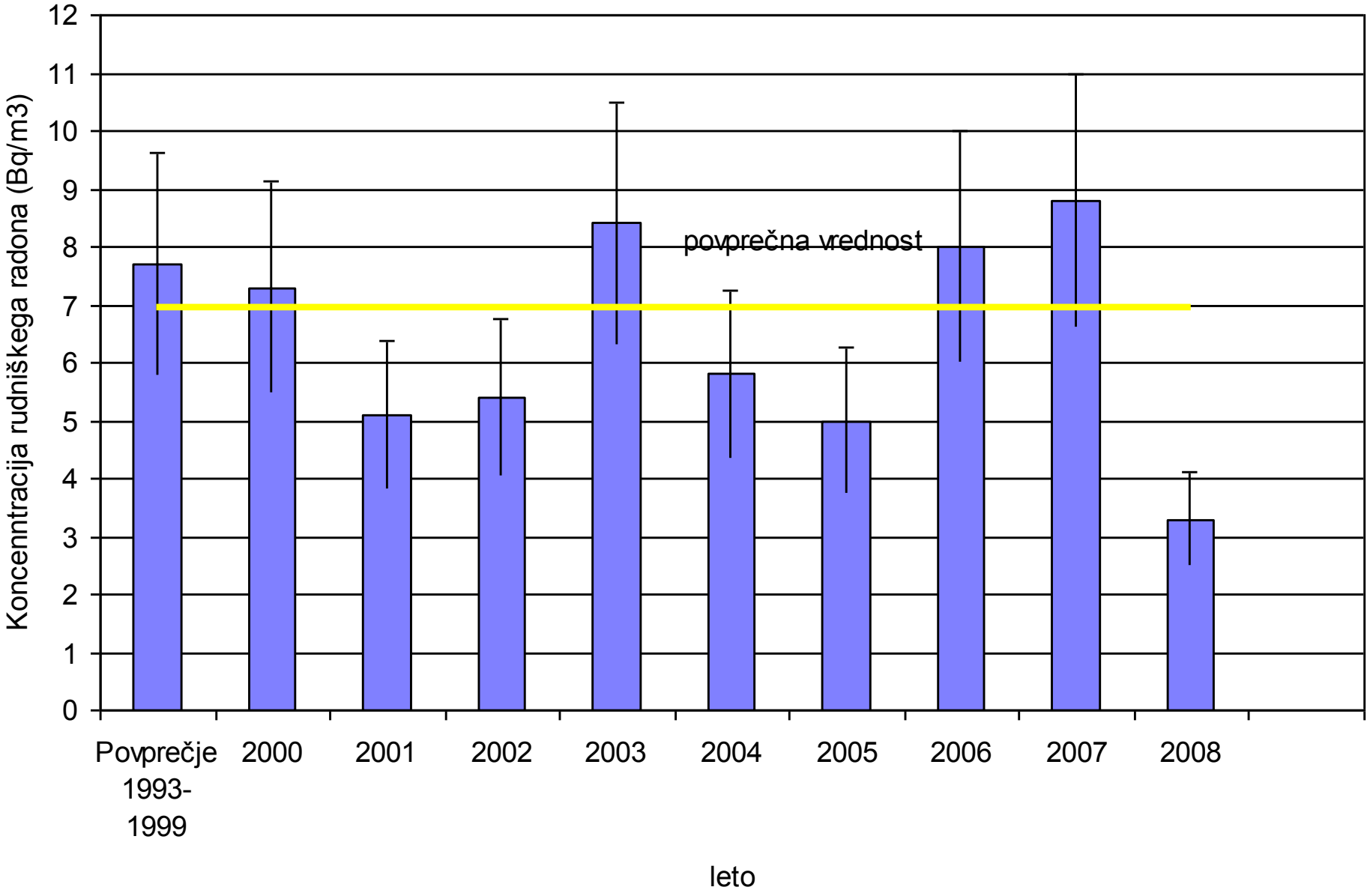
- Soft rush received the highest dose rate among terrestrial plants
- Other organisms should be assessed due to their presence in the local streams
- Application of other models is suggested to compare the results



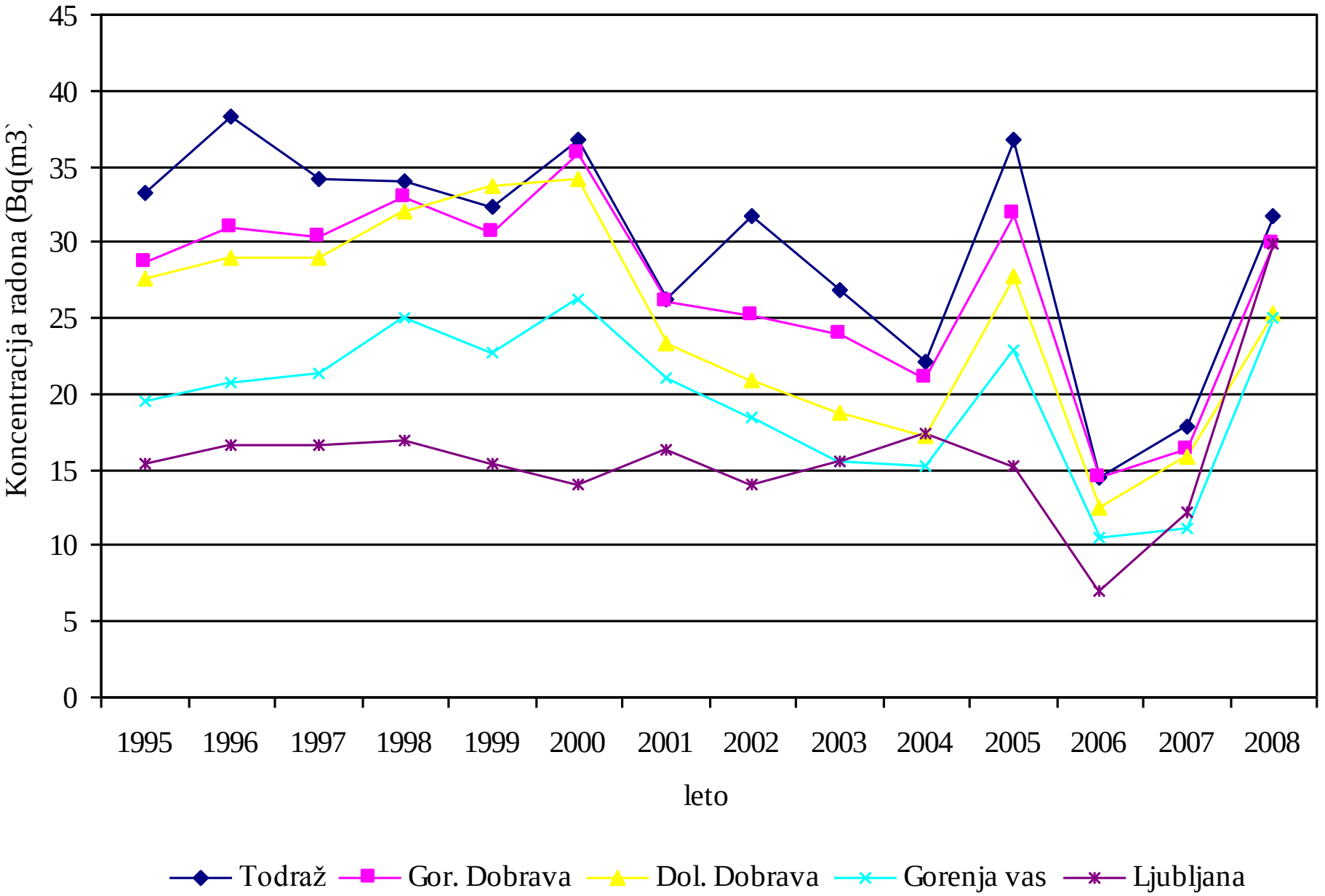
Average yearly concentrations in air at the Todraž site



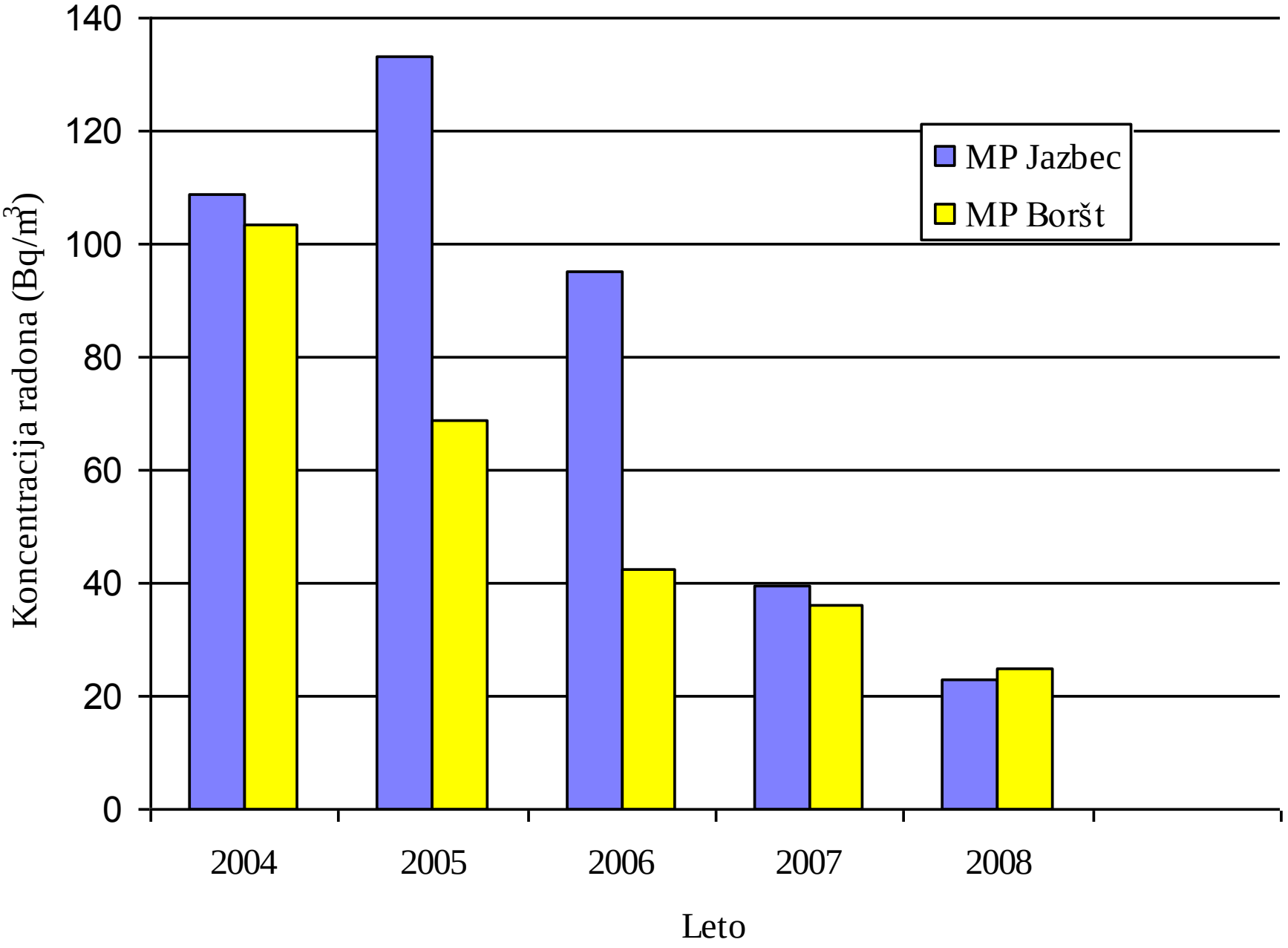
Sampling sites for Rn using track detectors (FK, Karlsruhe)



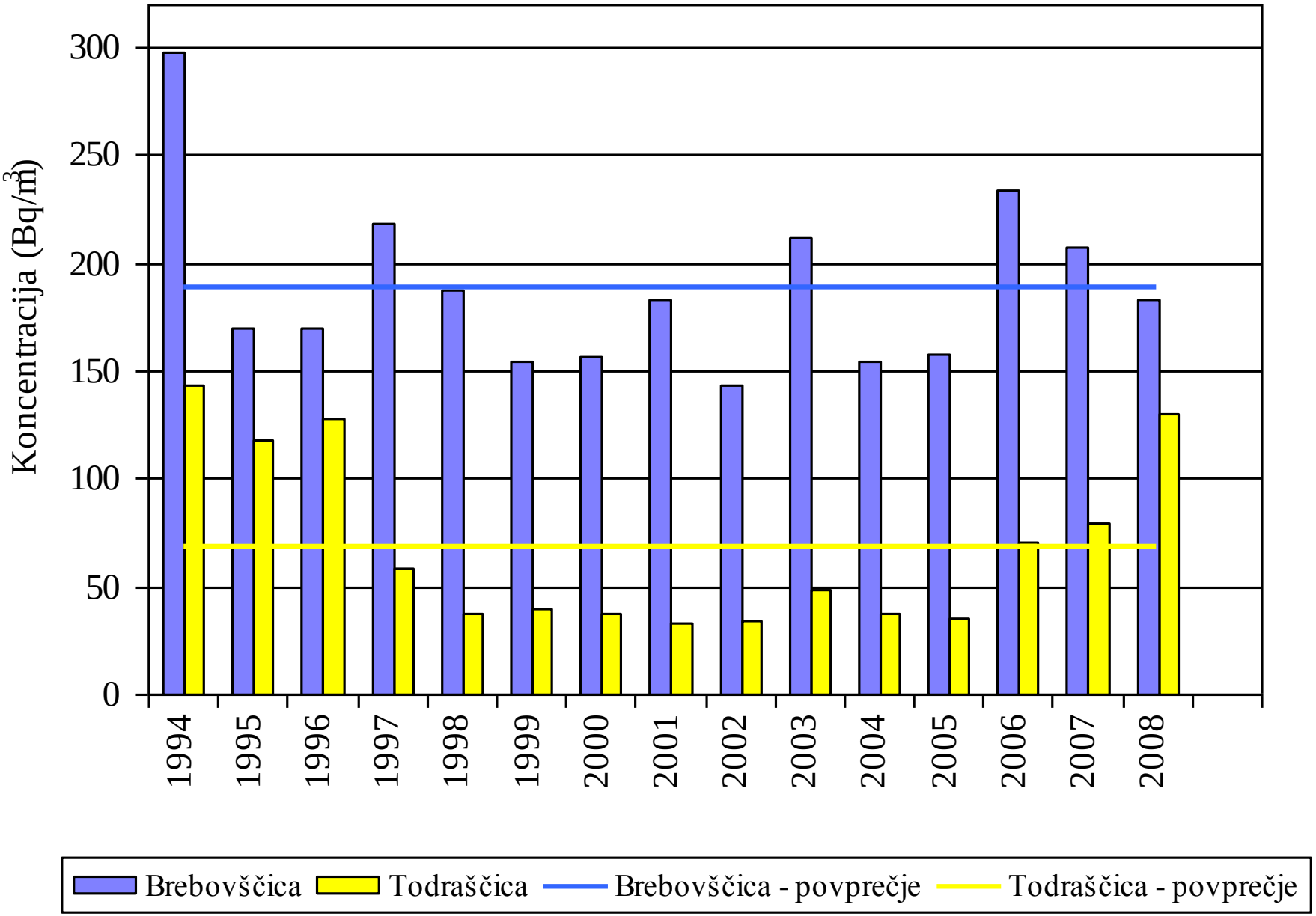
Contribution of the mine Rn



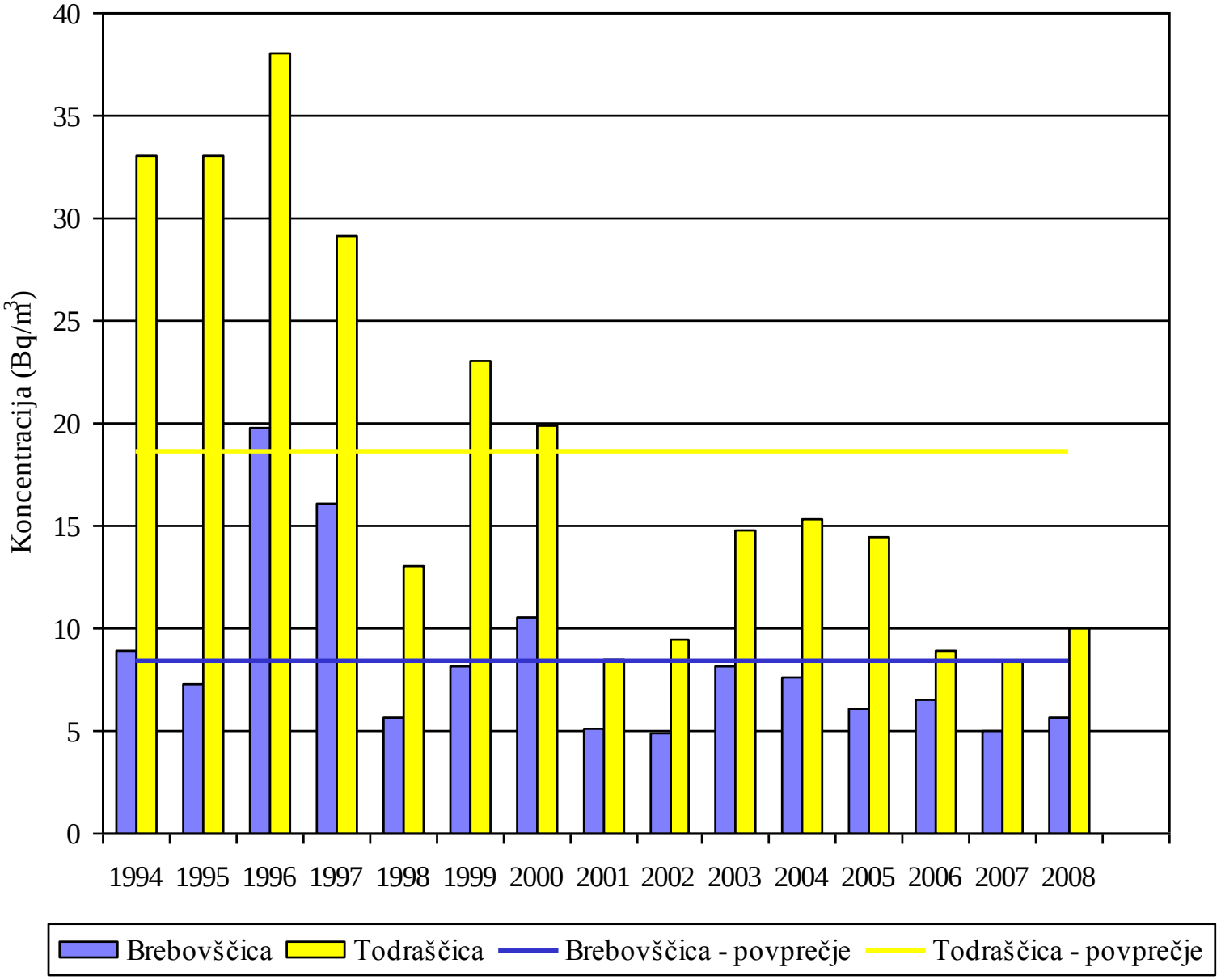
Average yearly Rn concentrations using charcoal adsorbers



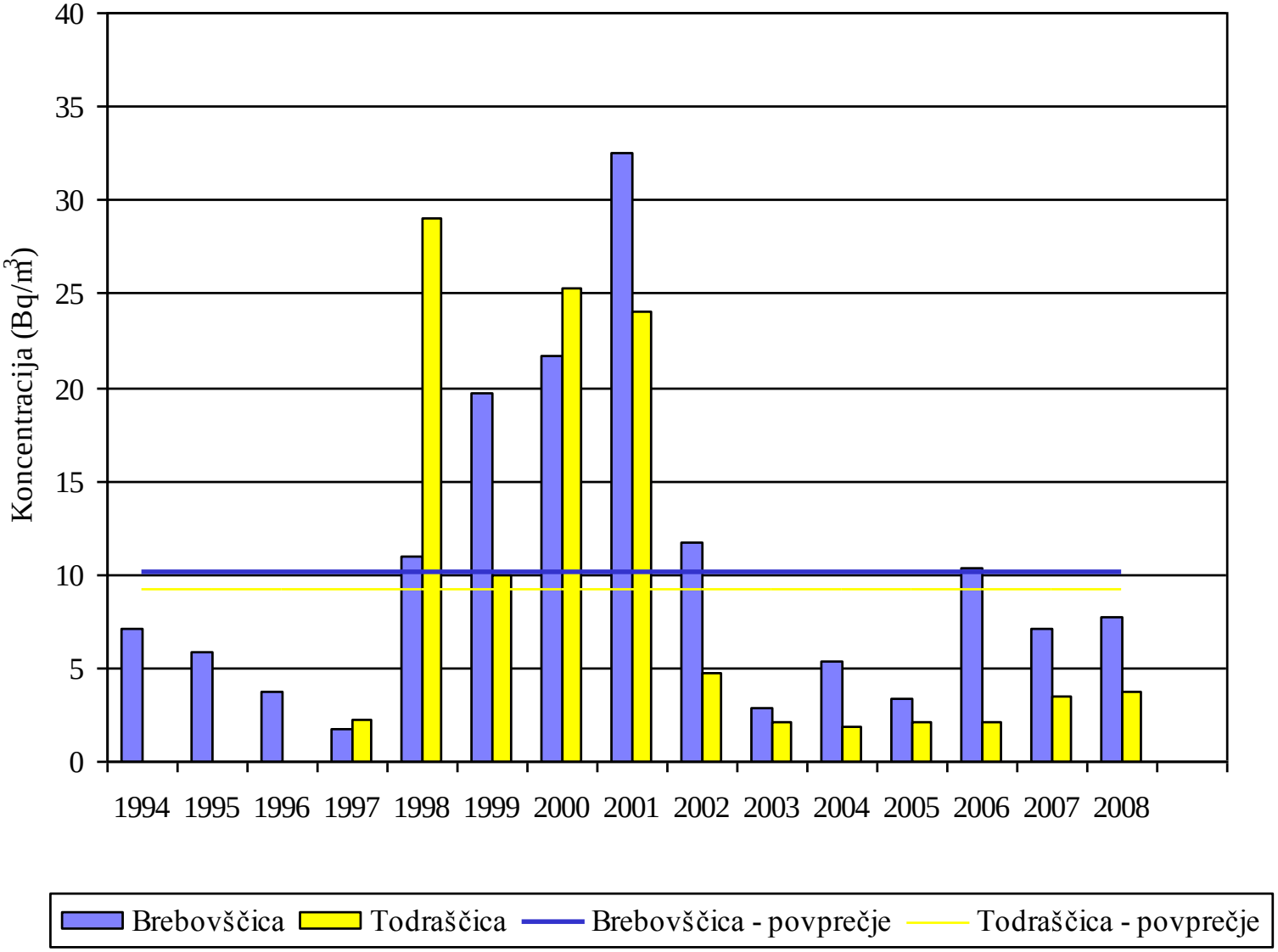
Rn concentrations (track detectors) at two waste piles



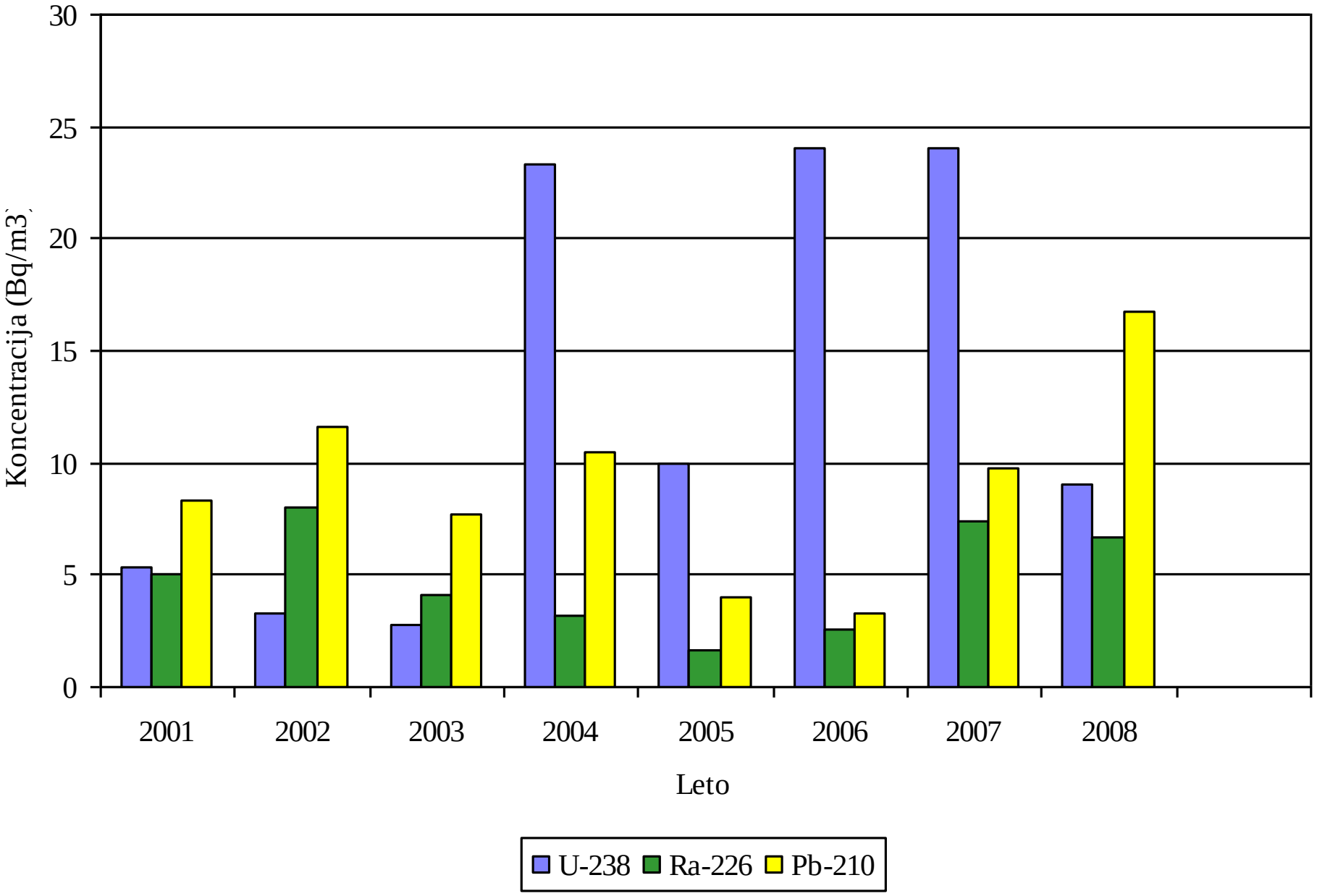
Average yearly concentrations of U in Brebovščica and Todražčica streams



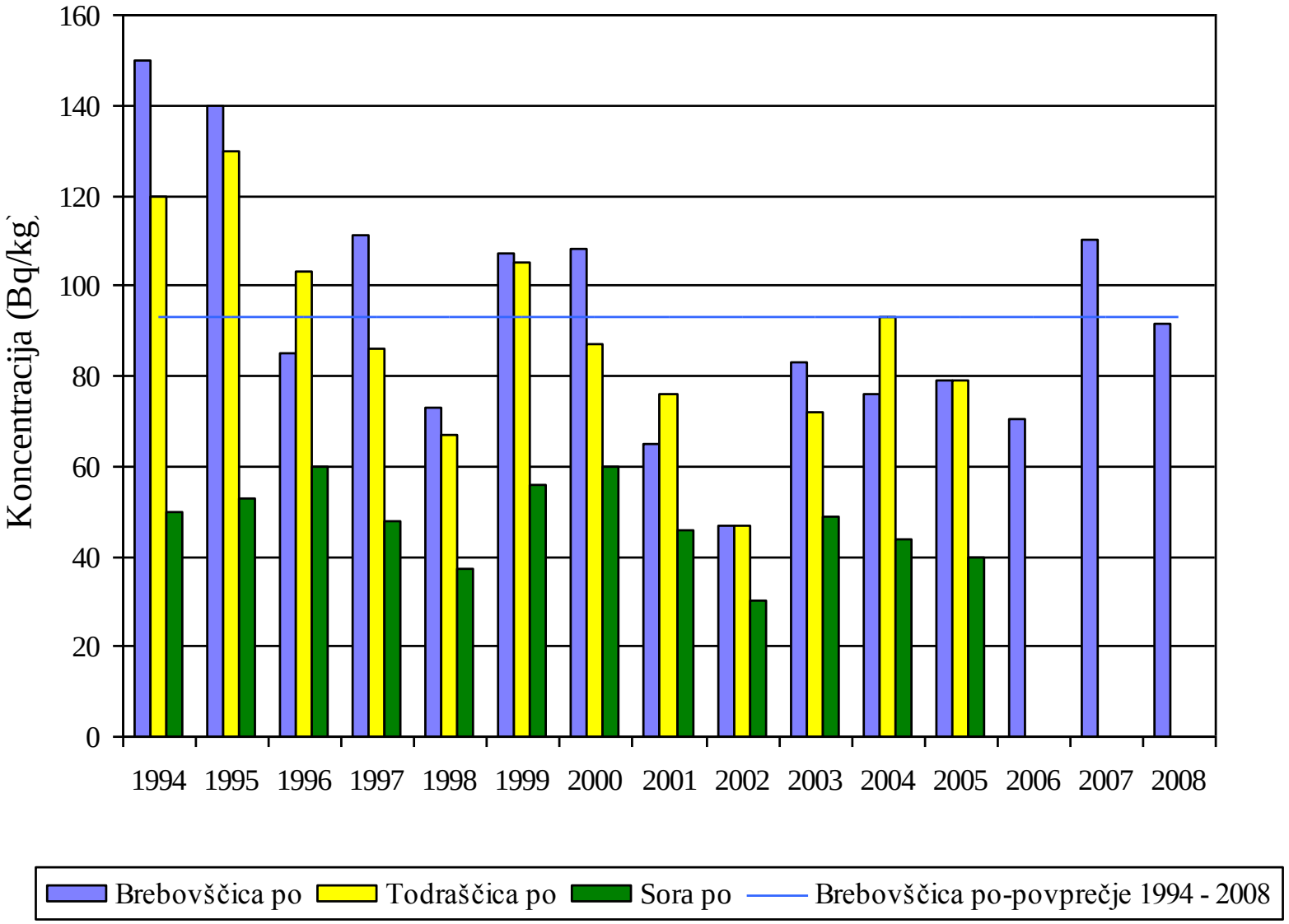
Average yearly concentrations of Ra in Brebovščica and Todražčica streams



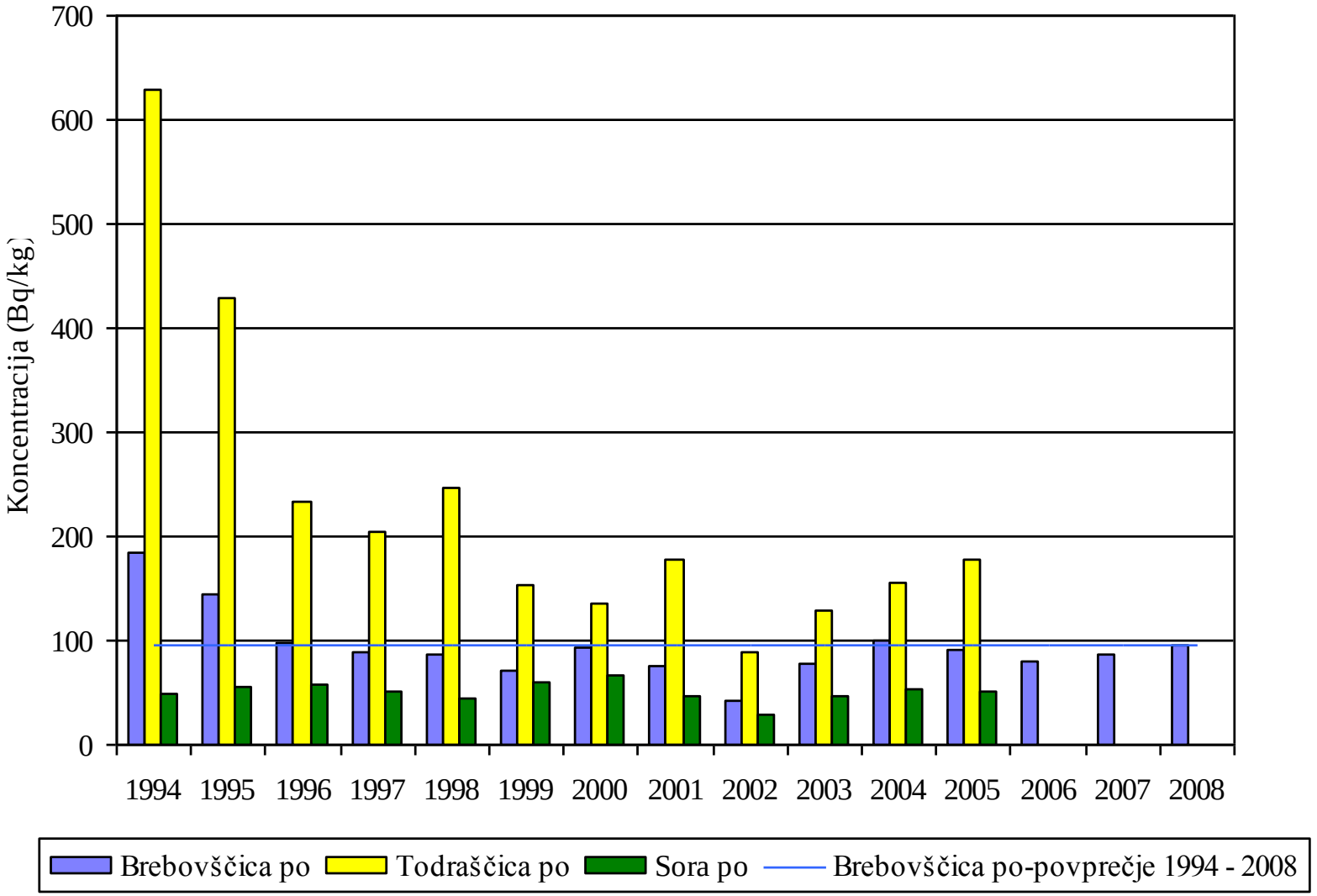
Average yearly concentrations of Pb-210 in Brebovščica and Todražčica streams



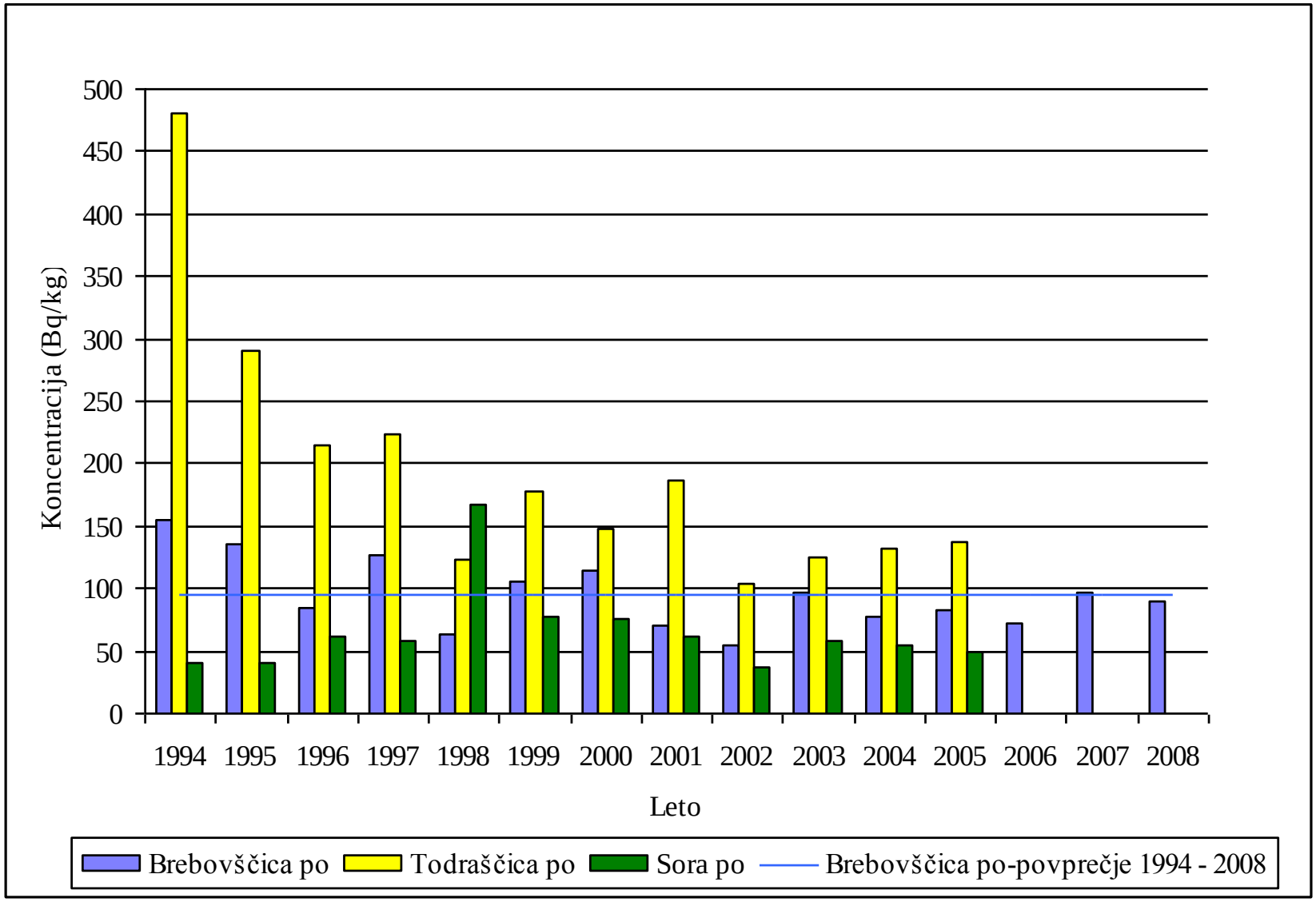
Concentrations in one of the wells



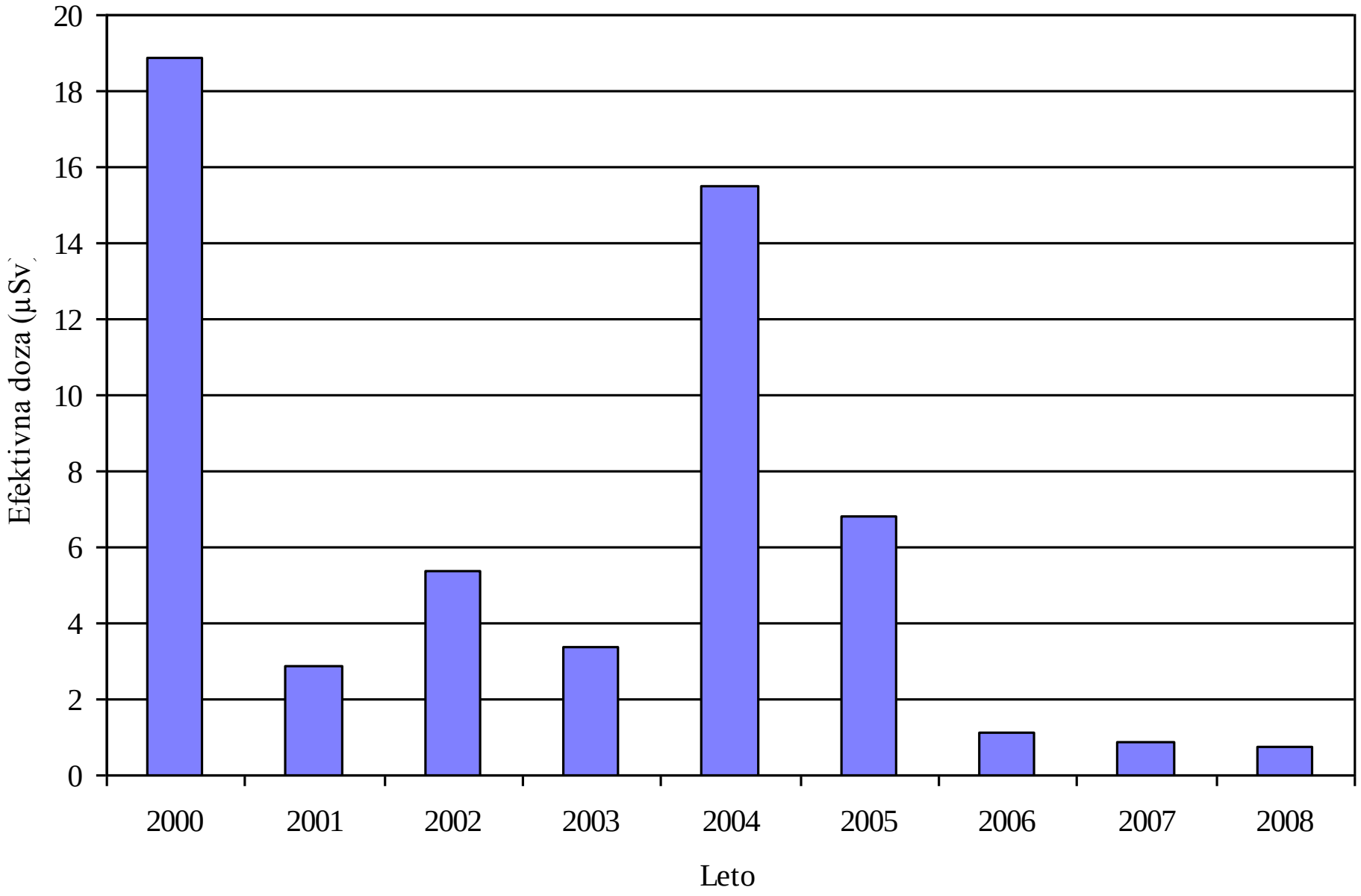
Activity concentrations of U-238 in sediments



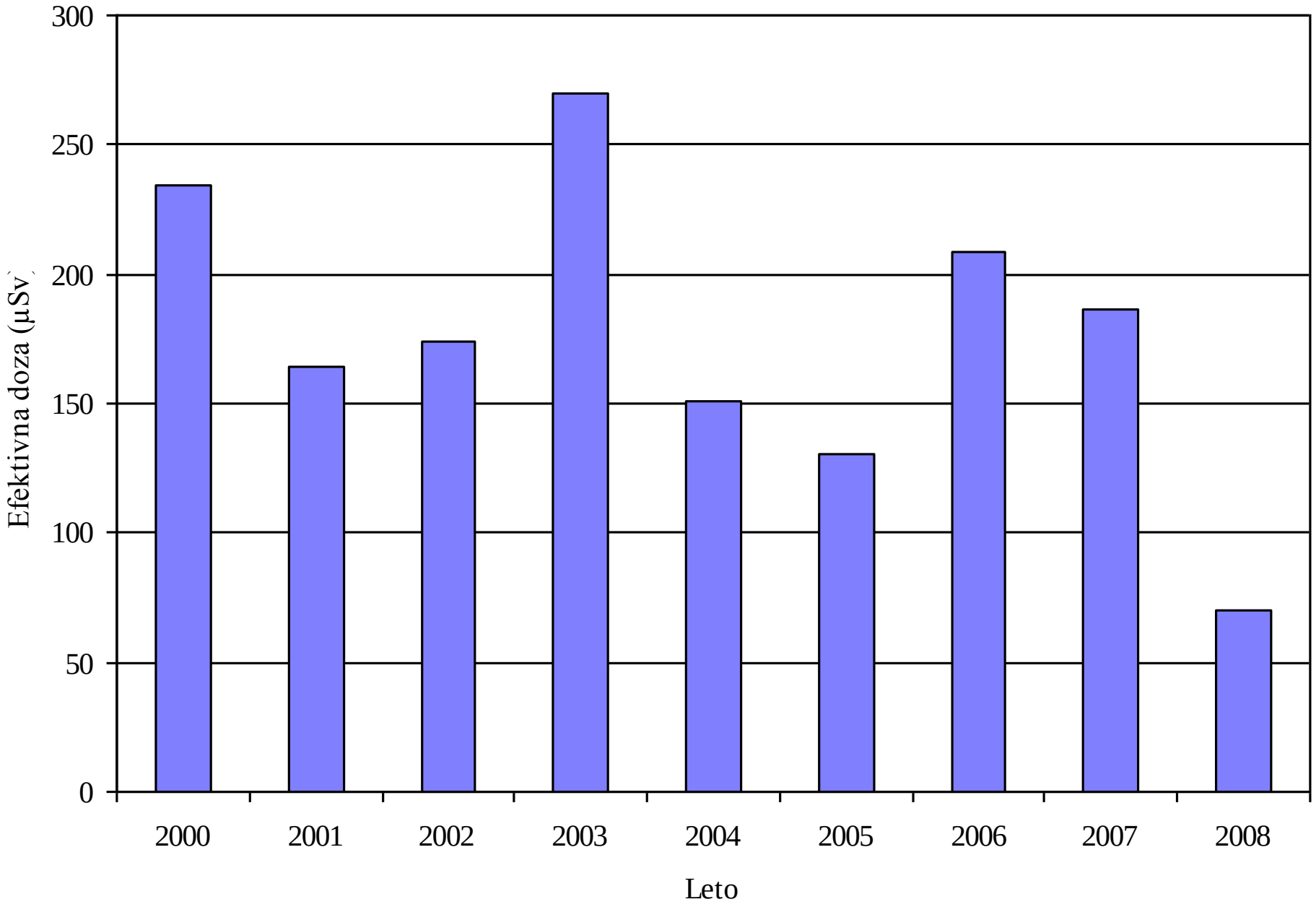
Activity concentrations of Ra-226 in sediments



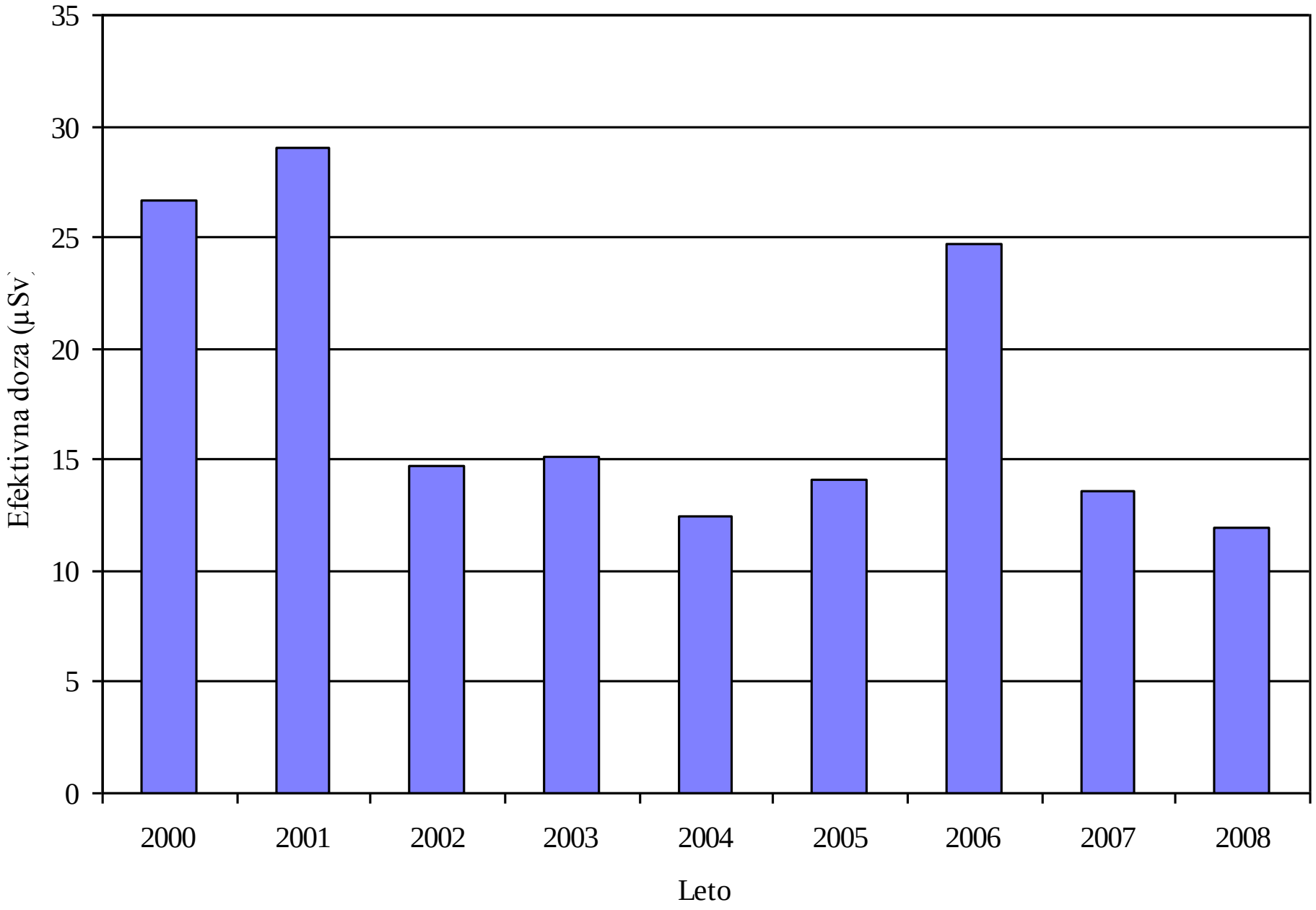
Activity concentrations of Pb-210 in sediments



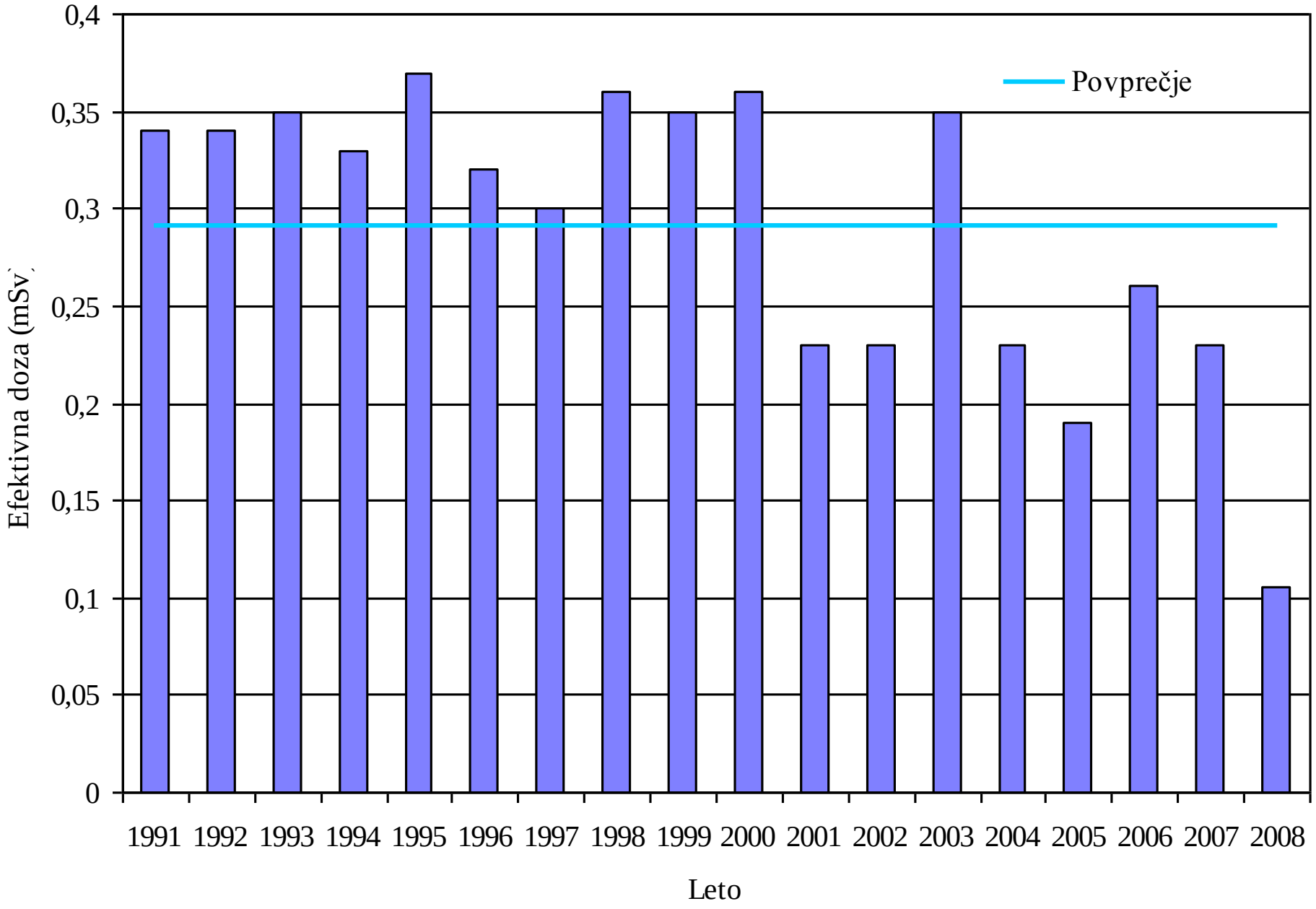
Effective dose due to inhallation of long-lived radionuclides



Effective dose due to inhallation of short-lived Rn progenies



Effective dose due to drinking river water



Overall effective dose due to RŽV

Thank You for Your Attention!